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## Declaration

I, Michihiko Matsuba, President of Fukuyama Sangyo Honyaku Center, Ltd., of 16-3, 2-chōme, Nogami-cho, Fukuyama, Japan, do solemnly and sincerely declare that I understand well both the Japanese and English languages and that the attached document in English is a full and faithful translation, of the copy of Japanese Unexamined Utility Model No. Sho-64-34623 laid open on March 2, 1989.



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WATERPROOF CAMERA

Japanese Unexamined Utility Model No. Sho-64-34623

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Inventor: Atsuro Yajima

Applicant: Nitto Kogaku Co., Ltd.

SPECIFICATION

1. TITLE OF THE UTILITY MODEL

WATERPROOF CAMERA

2. WHAT IS CLAIMED IS:

A waterproof camera, wherein a front lightproof ring having a plurality of spring bearing claws on a rear end surface is fitted movably forward or backward to a bull's-eye-like front lightproof plate fixed to a front end surface of a lens-barrel-guiding cylindrical body of a camera body in which the lens-barrel-guiding cylindrical body concentrically protrudes through a diameter-widening stepped portion to a front end of a lightproof barrel; whereas a lens-barrel-holding ring in which an outer ring having an engagement collar engaged with

a rear end surface of the front lightproof ring and a slit to which the spring bearing claw is loosely fitted and an inner ring holding a lens barrel are integrally formed with an interval therebetween on a rear side of a disk having a light guiding opening at a central part is fitted movably forward or backward into the front lightproof ring while interposing a spring caught by the spring bearing claw between the outer ring and the inner ring; and a camera main body to which a focus-switching lightproof member is fixed in which a bull's-eye-like rear lightproof plate fitted movably forward or backward into the lens-barrel-guiding cylindrical body and a rear lightproof ring fitted movably forward or backward into the lightproof barrel are integrally formed at a rear end of the lens barrel is contained in an outer hull body to which a rear lid is water-tightly screwed at a rear face part of a front cover in which a lens-barrel-guiding-cylindrical-body-protecting cylindrical portion on which a lightproof windowpane is water-tightly mounted is formed at a front face part.

### 3. DETAILED DESCRIPTION OF THE UTILITY MODEL

#### [Field of the Utility Model]

This invention relates to a waterproof camera.

#### [Description of Related Art]

Conventionally, there is a waterproof camera in which a camera main body is contained in an outer hull body in which a rear lid is water-tightly and closably screwed to a rear face part of a front cover having a lens-barrel-guiding-cylindrical-body-protecting cylindrical portion on which a light-penetrating windowpane is water-tightly mounted at a front face part.

[Object]

Furthermore, in this conventional waterproof camera, there is a need to enlarge a moving range of a photographic lens in order to raise a focal-length changing magnification, and a light-blocking range where light is blocked is expanded proportionally with the enlargement of the moving range of the photographic lens, and a protraction degree occurring when the photographic lens is drawn out increases proportionally therewith, and therefore it is inevitable that the front face part of the outer hull body with which the drawn photographic lens is covered will assume a more protruding shape. Disadvantageously, an increase in the protraction degree leads to an enlargement of the waterproof camera.

This invention has been made in consideration of these circumstances and aims to provide a waterproof camera capable of restricting the size enlargement although a focal-length

changing magnification is raised.

[Means for solving the object]

In order to achieve the aim, this invention is a waterproof camera characterized in that a front lightproof ring having a plurality of spring bearing claws on a rear end surface is fitted movably forward or backward to a bull's-eye-like front lightproof plate fixed to a front end surface of a lens-barrel-guiding cylindrical body of a camera body in which the lens-barrel-guiding cylindrical body concentrically protrudes through a diameter-widening stepped portion to a front end of a lightproof barrel, whereas a lens-barrel-holding ring in which an outer ring having an engagement collar engaged with a rear end surface of the front lightproof ring and a slit to which the spring bearing claw is loosely fitted and an inner ring holding a lens barrel are integrally formed with an interval therebetween on a rear side of a disk having a light guiding opening at a central part is fitted movably forward or backward into the front lightproof ring while interposing a spring caught by the spring bearing claw between the outer ring and the inner ring, and a camera main body to which a focus-switching lightproof member is fixed in which a bull's-eye-like rear lightproof plate fitted movably forward or backward into the lens-barrel-guiding cylindrical body and

a rear lightproof ring fitted movably forward or backward into the lightproof cylindrical body are integrally formed at a rear end of the lens barrel is contained in an outer hull body to which a rear lid is water-tightly screwed at a rear face part of a front cover in which a lens-barrel-guiding-cylindrical-body-protecting cylindrical portion on which a lightproof windowpane is water-tightly mounted is formed at a front face part.

[Operation]

The waterproof camera according to this invention has the aforementioned structure, and, in switching from an ordinary photographic state in which the front lightproof ring, the lens-barrel-holding ring, and the lens barrel have been retracted to a telephotographic state, the lens-barrel-holding ring and the lens barrel are protracted together initially, and a spring interposed between an outer ring and an inner ring that constitute the lens-barrel-holding ring extends at this time, and, although the front lightproof ring is prevented from moving forward together with the lens-barrel-holding ring and the lens barrel because of the urging of this spring, the front lightproof ring is protracted together with the lens-barrel-holding ring and the lens barrel when an engagement collar of the lens-barrel-holding ring is

engaged with the rear end surface of the front lightproof ring, and a telephotographic state is reached.

As mentioned above, since the front lightproof ring being in the telephotographic state in which the lens barrel has been protracted reaches the state of being retracted by an interval between the rear end surface of the front lightproof ring and the engagement collar of the lens-barrel-holding ring in the ordinary photographic state with respect to the lens-barrel-holding ring in comparison with the ordinary photographic state in which the lens barrel has been retracted, a front-end opening edge on which a light-penetrating windowpane of an outer hull body has been mounted can be retracted to the extent of this interval.

Further, when the lens barrel is protracted, the blocking in a state in which a range to be blocked has been enlarged can be achieved by drawing the rear lightproof ring that constitutes the focus-switching lightproof member fixed to the lens barrel from the lightproof barrel.

Further, when the lens barrel is protracted or retracted, the lens barrel is smoothly guided by the lens-barrel-guiding cylindrical body because the rear lightproof plate that constitutes the focus-switching lightproof member fixed to the lens barrel is protracted or retracted in the state of being

fitted in the lens-barrel-guiding cylindrical body.

[Embodiment]

A detailed description will be hereinafter given of an embodiment of the waterproof camera according to this invention with reference to the drawings shown herein.

In FIG. 1, X is the waterproof camera, which is made up chiefly of a camera main body Y and an outer hull body Z watertightly including and holding the camera main body Y.

The camera main body Y is made up of a camera body 10, a front lightproof plate 20, a front lightproof ring 30, a lens-barrel-holding ring 40, a lens barrel 50 on which a photographic lens 100 is mounted, a focus-switching lightproof member 60, a shutter member 70, an auxiliary lens 101, and other elements, which are not shown and are not described, i.e., a focus-switching mechanism, a shutter operation activating mechanism, an auxiliary-lens advancing/retracting operating mechanism, and a driving motor. The outer hull body Z is made up of a front cover 80 and a back lid 90.

Furthermore, the camera body 10 is almost the same as the conventional one and has a lens-barrel-guiding cylindrical body 12 enclosing an optical-path-forming portion through a diameter-widening stepped portion 11 on the front surface side; a lightproof barrel 13 concentric with and smaller in diameter

than the lens-barrel-guiding cylindrical body 12 on the rear surface side, a spool chamber 14 opened backward on one side of the lightproof barrel 13, a cartridge chamber 15 opened backward on the other side of the lightproof barrel 13, and a battery chamber 16 outside the cartridge chamber 15. A spool 17 is mounted in the spool chamber 14 so as to be rotated by a driving mechanism not shown.

The front lightproof plate 20 is formed by applying antireflection processing onto a bull's-eye-like disk having a through-hole 21 at the central part. This front lightproof plate 20 is fixed to be concentric with the front end surface of the lens-barrel-guiding cylindrical body 12 of the camera body 10. As shown especially in FIG. 3 and FIG. 4, the front lightproof ring 30 is formed by a collar 31 engaged with the front surface of the front lightproof plate 20 at the front end part consisting mainly of a ring fitted movably forward or backward to or from the through-hole 21 of the front lightproof plate 20 and by several spring bearing claws 34, . . . to engage the rear end of a spring 33 interposed between an outer ring 42 and an inner ring 43 that constitute the lens-barrel-holding ring 40 described later which are caused to protrude inward at substantially equal intervals at the rear end surface 32.

In the lens-barrel-holding ring 40, an outer ring 42 having an outer diameter equal to that of a disk 41 is integrally formed with an elastic material at an outer edge of the rear side of the disk 41 that is fitted to the front end opening 35 of the front lightproof ring 30 and that has a funnel-like light guiding opening 44 at the central part, and an inner ring 43 that is fitted to the inner end face of the spring bearing claws 34, . . . of the front lightproof ring 30 is integrally formed with an elastic material in the vicinity of the light guiding opening 44 of the rear side of the disk 41. An engagement collar 45 is formed to protrude outward at the rear end edge of the outer ring 42, and slits 46, . . . to which the spring bearing claws 34, . . . of the front lightproof ring 30 are loosely fitted are formed at the rear end of the outer ring 42, and the lens barrel 50 is held in the inner ring 43.

The focus-switching lightproof member 60 is formed by integrally forming an annular projection 62 fixed to the rear end surface of the lens barrel 50 on the front side of a bull's-eye-like rear lightproof plate 61 fitted movably forward or backward in the lens-barrel-guiding cylindrical body 12 of the camera body 10 and a rear lightproof ring 63 fitted movably forward or backward in the lightproof barrel 13 of the camera body 10 on the rear side thereof, and the

shutter member 70 is disposed on the rear lightproof plate 61.

The focus-switching lightproof member 60, the lens-barrel-holding ring 40, and the lens barrel 50 on which the photographic lens 100 is mounted are protracted or retracted together, and a range to be protracted or retracted is restricted by the rear lightproof plate 61, the front lightproof plate 20, and the diameter-widening stepped portion 11.

101 is an auxiliary lens that cooperates with the photographic lens 100 in telephotography. This auxiliary lens 101 is retracted out of the optical path of the photographic lens 100 in usual photography and is protracted backward from the photographic lens 100 in telephotography by an auxiliary-lens advancing/retracting operating mechanism, not shown, that responds to a focus-switching mechanism not shown, so that the optical axis of the photographic lens 100 coincides with the optical axis of the auxiliary lens 101.

Further, at the front cover 80, a truncated-cone-like lens-barrel-guiding-cylindrical-body-protecting cylindrical portion 81 having a central axis line that coincides with the central axis line shared between the lightproof barrel 13 and the lens-barrel-guiding cylindrical body 12 is formed at the front face part with which the front

surface of the camera main body Y is covered, and a light-penetrating windowpane 83 is water-tightly mounted on the front-end opening edge 82 by an O ring 84 and by an annular pressing member 86 having a funnel-like light guiding opening 86' fixed to the interior part of the front-end opening edge 82 with a bis-screw 85, whereas an elastic body 89 for waterproofing is inserted into a groove 88 for waterproofing that is formed by hollowing a rear-end opening edge 87 of the part covering the side face of the camera main body Y.

Further, at the back lid 90, a projection 91 that is engaged with the inner surface 18 of the outer wall part of the spool chamber 14 of the camera body 10 and a projection 92 that is engaged with the inner surface 19 of the outer wall part of the cartridge chamber 15 are formed on the inner surface of the lid plate, and a protruding bar 94 for waterproofing that cooperates with the elastic body 89 for waterproofing of the front cover 80 is erected on a rim portion 93 formed to fit the rear-end opening edge 87 of the front cover 80, and a pressure plate 95 by which a film is pressed against the rear-end opening edge 13' of the lightproof barrel 13 is attached between the projections 91 and 92. The outer hull body Z is formed by openably and closably attaching the back lid 90 to the front cover 80 by means of a hinge not shown,

and the interior of the outer hull body Z is kept watertight when the back lid 90 is closed.

In order to contain the camera main body Y in the outer hull body Z, the peripheral edge part of the front lightproof plate 20 is fixed to the inner surface of the lens-barrel-guiding-cylindrical-body-protecting cylindrical portion 81, and the funnel-like light guiding opening 86' of the annular pressing member 86 is fixed to the front surface of the front lightproof plate 20, and the camera main body Y is fixed to the front cover 80 by fitting the side face of the camera body 10 to the front cover 80, and then the back lid 90 is closed to become watertight.

Since the waterproof camera according to this invention is structured as mentioned above, the protruding bar 94 for waterproofing that has been erected on the rim portion 93 of the back lid 90 bites into the elastic body 89 for waterproofing that has been inserted in the groove 88 for waterproofing that has been formed by hollowing the rear end opening edge 87 of the front cover 80 when the back lid 90 is opened, a film is then loaded, and the back lid 90 is closed. Thereby, the interior of the outer hull body Z becomes watertight, and a photographable state is reached.

Thereafter, when a focus-changing switch of the focus-

switching mechanism not shown is operated, the lens barrel of the waterproof camera is switched from the ordinary photographic state of FIG. 1 to the telephotographic state of FIG. 2 or vice versa, and, when it is switched to telephotography, the lens barrel 50 on which the photographic lens 100 has been mounted is protracted as shown in FIG. 2, and the auxiliary lens 101 is protracted backward from the photographic lens 100, the optical axis of the photographic lens 100 is caused to coincide with the optical axis of the auxiliary lens 101. If the lens-barrel-holding ring 40 and the lens barrel 50 are protracted together by the focus-switching mechanism not shown at this time, the spring 33 interposed between the outer ring 42 and the inner ring 43 that constitute the lens-barrel-holding ring 40 extends, and the front lightproof ring 30 is prevented from moving forward together with the lens-barrel-holding ring 40 and the lens barrel 50 because of the urging of the spring 33. However, when the engagement collar 45 of the lens-barrel-holding ring 40 is engaged with the rear end surface 32 of the front lightproof ring 30, the front lightproof ring 30 is protracted together with the lens-barrel-holding ring 40 and the lens barrel 50, and a telephotographic state shown in FIG. 2 is reached.

As mentioned above, the front lightproof ring 30 placed in the telephotographic state (see FIG. 2) in which the lens barrel 50 on which the photographic lens 100 has been mounted is protracted is retracted by an interval  $\ell$  between the engagement collar 45 of the lens-barrel-holding ring 40 and the rear end surface 32 of the front lightproof ring 30 in the ordinary photographic state with respect to the lens-barrel-holding ring 40 in comparison with the ordinary photographic state (see FIG. 1 and FIG. 3), the front-end opening edge 82 on which the light-penetrating windowpane 83 of the outer hull body 2 has been mounted can be retracted to the extent of this interval  $\ell$ .

Additionally, when the lens barrel 50 is protracted, the focus-switching lightproof member 60 is protracted together with the lens barrel 50, and the rear lightproof ring 63 that is a constituent element of the lightproof member 60 is drawn from the lightproof barrel 13, and hence blocking in a state where a range to be blocked is enlarged can be achieved.

Additionally, when the lens barrel 50 is protracted or retracted, the bull's-eye-like rear lightproof plate 61 that is a constituent element of the focus-switching lightproof member 60 fixed to the lens barrel 50 is protracted or retracted in the state of being fitted in the lens-barrel-guiding

cylindrical body 12, and hence the lens barrel 50 can be smoothly protracted or retracted.

[Effect of the invention]

As is apparent from the foregoing description, according to this invention, even if the focal-length changing magnification of the waterproof camera is enlarged, blocking in a state where a range to be blocked has been enlarged can be achieved, and the lens barrel can be smoothly protracted or retracted, and the front-end opening edge to which the light-penetrating windowpane of the outer hull body has been attached can be retracted, and it becomes possible to provide a waterproof camera capable of restricting size enlargement of the waterproof camera by reducing a protraction degree of the outer hull body to the extent of the retraction.

4. BRIEF DESCRIPTION OF THE DRAWINGS

The drawings show the embodiment of this invention, in which FIG. 1 is a longitudinal sectional side view showing an ordinary photographic state, FIG. 2 is a longitudinal sectional side view showing a telephotographic state, FIG. 3 is a partially cutaway side view of a main part, and FIG. 4 is a rear view of a part of the main part.

X: Waterproof camera

Y: Camera main body  
10: Camera body  
12: Lens-barrel-guiding cylindrical body  
20: Front lightproof plate  
32: Rear end surface  
34: Spring bearing claw  
41: Disk  
43: Inner ring  
45: Engagement collar  
11: Diameter-widening stepped portion  
13: Lightproof barrel  
30: Front lightproof ring  
33: Spring  
40: Lens-barrel-holding ring  
42: Outer ring  
44: Light guiding opening  
46: Slit  
50: Lens barrel  
60: Focus-switching lightproof member  
61: Rear lightproof plate  
Z: Outer hull body  
63: Rear lightproof ring  
80: Front cover

81: Lens-barrel-guiding-cylindrical-body-protecting  
cylindrical portion

83: Light-penetrating windowpane

90: Back lid

Applicant for registration of utility model

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Fig.1

